3.16 Forest Carbon Cycling and Storage

Introduction

This report describes the evidence and rationale why we believe additional analysis of the Como Forest Health project effects on carbon storage potential and climate change is not warranted under NEPA for a proposal of this scope. Nevertheless, as we recognize this is a relatively new public issue, and in deference to those who commented, a qualitative analysis of this project's effects on climate change and carbon cycling and storage is provided.

3.16.1 Overview of Issues Addressed – Carbon cycling and storage

Public comments during scoping for the Como Forest Health project asked that the Forest Service "disclose the impact of the proposed project on the carbon storage potential of the area."

The importance of carbon storage capacity of the world's forests is tied to their global role in removing atmospheric carbon that contributes to ongoing global warming. As discussed below, meaningful and relevant conclusions on the effects of a relatively minor land management action such as this one global on greenhouse gas emissions or global climate change is neither possible nor warranted.1 Nevertheless, we recognize that global research indicates the world's climate is warming and that most of the observed 20th century increase in global average temperatures is very likely due to increased human-caused greenhouse gas emissions.

Forests cycle carbons are in a continual flux, both emitting carbon into the atmosphere and removing it (sequestration) through photosynthesis. The proposed actions considered in this analysis may alter the rates and timing of that flux within the individually affected forest stands. These changes would be localized and infinitesimal relative to the role the world's forests play in modifying climate change and would be indistinguishable from the effects of not taking action. Nevertheless, in response and deference to those who commented, effects of the proposal on carbon cycling and storage are discussed below. Regional, continental, and global factors related to forest's influence on global climate change are also briefly discussed to provide context for understanding the nature of these local effects.

3.16.2 Overview of Issues Addressed – Efficacy of the Proposed Action in light of climate change

Public comments during scoping for the Como Forest Health Project state that "…published scientific reports indicate that climate change will lead to increased wildfire severity (including drier and warmer conditions that may render obsolete the proposed

[1] While huge advances have been made in accounting and documenting the relationship between greenhouse gases and global climate change, difficulties remain in reliably simulating and attributing observed temperature changes to natural or human causes *at smaller than continental scales* (IPCC 2007, pg. 72).

effects of the Project)," and this, "undermines the central underlying purpose of the Project."

We disagree with the conclusion reached in this comment for several reasons.

This proposal has several desired outcomes. The effectiveness of achieving those outcomes is presented throughout the analysis in the EIS (keeping in mind that NEPA requires an agency to take a hard look at the consequences of its actions on the environment, not the other way around).

The interdisciplinary team carefully considered the existing conditions and trends in the project area, as well as risks, in designing this proposal to achieve those outcomes (FEIS 3.1-4 to 3.1-10, 3.1-34 to 3.1-38). Global climatic warming is not something that is about to happen. It has been ongoing for many decades and the trend is expected to continue into the distant future, continuing to increase risks to our nation's forests (Dale, et al. 2001; Barton 2002; Breashears and Allen 2002; Westerling and Bryant 2008; Running 2006; Littell, et al. 2009; Boisvenue and Running 2010, Hicke et al. 2012). The existing project area conditions and trends are an expression of the local climate (which may or may not parallel ongoing regional, continental, or global trends) as it has interacted with the other local natural and human-caused influences. As such, the ongoing effects of climate change were considered in developing the proposal.

This proposal by necessity addresses site specific forest health, specifically mountain pine beetle infestation potential, and fuels conditions. Nevertheless, the proposed actions are consistent with adaptation actions and strategies recommended for managing forests in light of climate change (Millar, et al. 2007; Joyce, et al. 2008; Ryan, et al. 2008a).

3.16.3 Regulatory Direction

There are no applicable legal or regulatory requirements or established thresholds concerning management of forest carbon or greenhouse gas emissions.

NEPA requires that agencies consider significant effects of proposed actions on the human environment in our decisions.

3.16.3.1 Guidance on Consideration of Climate Change in Project Related NEPA

Council on Environmental Quality

The Council on Environmental Quality (CEQ) has issued draft guidance for public consideration and comment on "Consideration of the Effects of Climate Change and Greenhouse Gas Emissions" (Federal Register Volume 75, Number 35 page 8046). This draft guidance is not yet applicable to this analysis. Moreover, CEQ explicitly excluded Federal land and resource management from the draft guidance. Rather, the CEQ solicited public comment on the appropriate means of assessing the greenhouse gas emissions and sequestration that are affected by Federal land and resource management decisions.

Forest Service

The Forest Service has prepared agency guidance on "Climate Change Considerations in Project Level NEPA Analysis" (http://www.fs.fed.us/emc/nepa/climate_change/index.htm). In general, this guidance

recognizes that while some actions may warrant qualitative or even quantitative analysis of their effects on climate change, they are at such a minor scale that the effects would be meaningless to a reasoned decision.

Other Contextual Considerations

Other factors also indicate that, in this case, further analysis is not necessary or warranted.

The top three human-caused contributors to greenhouse gas emissions (from 1970-2004) are: fossil fuel combustion, deforestation, and agriculture (IPCC 2007, p. 36). Land use change, primarily the conversion of forests to other land uses (deforestation) is the second leading source of human-caused greenhouse gas emissions globally (Denman, et al. 2007, pg. 512). Loss of tropical forests of South America, Africa, and Southeast Asia is the largest source of land-use change emissions (Denman, et al. 2007, pg. 518; Houghton 2005).

Unlike other forest regions that are a net source of carbon to the atmosphere, U.S. forests are a strong net carbon sink, absorbing more carbon than they emit (Houghton 2003; US EPA 2013; Heath, et al. 2011). For the period 2000 to 2008, U.S. forests sequestered (removed from the atmosphere, net) approximately 481.1 teragrams (Tg) of carbon dioxide per year, with harvested wood products sequestering an additional 101 Tg per year (Heath et al. 2011)2. National Forests accounted for approximately 30 percent of that net annual sequestration. National Forests contribute approximately 3 Tg carbon dioxide to the total stored in harvested wood products compared to about 92 Tg from harvest on private lands (Heath et al. 2011). Within the U.S., land use conversion from forest to other uses (primarily for development or agriculture) are identified as the primary human activities exerting negative pressure on the carbon sink that currently exists in this country's forests (McKinley, et al. 2011; Ryan, et al. 2010; Conant, et al. 2007).

This proposal does not fall within, and is distinguishable from, any of these primary contributors of global greenhouse gas emissions. It is also not similar to the primary human activities exerting negative pressure on the carbon sink that currently exists in U.S. forests, namely land use conversion. The affected forests will remain forests, not converted to other land uses, and long-term forest services and benefits will be maintained.

3.16.4 Affected Environment

3.16.4.1 Existing Condition

Forests are in continual flux, emitting carbon into the atmosphere, removing carbon from the atmosphere, and storing carbon as biomass (sequestration). Over the long-term, through one or more cycles of disturbance and regrowth (assuming the forest regenerates after the disturbance), net carbon storage is often zero because re-growth of trees recovers the carbon lost in the disturbance and decomposition of vegetation killed by the disturbance (McKinley, et al. 2011; Ryan, et al. 2010; Kashian, et al. 2006).

[2] 1 teragram (Tg) = approximately 2.2 billion pounds

The project area is characterized as mature ponderosa pine and Douglas-fir forest with lower amounts of lodgepole pine and subalpine fir in drainages and at the higher elevations. Generally most of these areas are stocked more heavily than desired as described in FEIS section 3.1. Thus, competition for water and nutrients is high and the trees in the area are more susceptible to mountain pine beetle infestation. At this stage of their development, these stands are estimated to be net carbon sinks. That is, they are likely sequestering carbon faster than they are releasing it to the atmosphere. The strength of that sink has likely been weakened in some stands due to recent scattered tree mortality from mountain pine beetle in ponderosa pine.

3.16.5 Environmental Consequences

3.16.5.1 Alternative 1 – No Action

Direct and Indirect Effects

There would be no direct human-induced emissions of carbon into the atmosphere under the No Action alternative. Forest stands would likely continue as carbon sinks until the next disturbance event (fire, wind, insect infestation, etc.) occurs. When the next forest stand replacing disturbance event (high tree mortality) occurs, the affected areas would convert to a carbon source condition (emitting more carbon than is being sequestered). This state would continue for up to a decade or more until the rate of forest regrowth, assuming trees regenerate, meets and exceeds the rate of decomposition of the dead trees. As stands continue to develop, the strength of the carbon sink would increase (typically peaking at an intermediate age and then gradually declining, but remaining positive) (Pregitzer and Euskirchen 2004). Carbon stocks would continue to accumulate, although at a declining rate, until again impacted by subsequent disturbance.

For at least the short term, on-site carbon stocks would remain higher under the No Action alternative than under the Proposed Action. Nevertheless, caution is advised against interpreting carbon inventory maintenance or gains from deferred or foregone timber harvest in any specific forest or stand as affecting atmospheric concentrations of greenhouse gases. This only holds true if harvest does not occur elsewhere in the world to supply the same world demand for timber (Gan and McCarl 2007; Murray 2008; Wear and Murray 2004). The result can be a net carbon impact if the timber is replaced in the marketplace with higher carbon source products such as steel or concrete or is harvested in a manner that does not result in prompt reforestation (McKinley, et al. 2011; Ryan, et al. 2010; Harmon 2009).

As discussed elsewhere, the risk of mountain pine beetle-caused tree mortality is greater under the no action alternative. The long-term ability of these forests to persist as a net carbon sink is uncertain (Galik and Jackson 2009). Drought stress, forest fires, insect outbreaks and other disturbances may substantially reduce existing carbon stock (Galik and Jackson 2009, Hicke et al. 2012). Climate change threatens to amplify risks to forest carbon stocks by increasing the frequency, size, and severity of these disturbances (Dale, et al. 2001; Barton 2002; Breashears and Allen 2002; Westerling and Bryant 2008; Running 2006; Littell, et al. 2009; Boisvenue and Running 2010). Recent research indicates that these risks may be particularly acute for forests of the Northern Rockies (Boisvenue and Running 2010). Increases in the severity of disturbances, combined with projected climatic changes, may limit post-disturbance forest regeneration, shift forests to non-

forested vegetation, and possibly convert large areas from an existing carbon sink to a carbon source (Barton 2002; Savage and Mast 2005; Allen 2007; Strom and Fulé 2007; Kurz, et al. 2008a; Kurz, et al. 2008b; Galik and Jackson 2009). Leaving areas of forest densely stocked, as in the no action alternative, maintains an elevated risk of carbon loss due to disturbance. Thinning, prescribed fire, and other management actions are often suggested as climate change "adaptation actions" because they may increase forest resilience to these multiple stresses, and thus increase the likelihood of sustaining forest carbon benefits in the long-term (Millar, et al. 2007; Joyce, et al. 2008; Ryan, et al. 2008b). The no action alternative foregoes such climate change adaptation actions.

3.16.5.2 Alternatives 2, 3, & 4 – The Action Alternatives

Direct and Indirect Effects

In the short term, the action alternatives would remove and release some carbon currently stored within treatment area biomass through harvest of live and dead trees and other fuel reduction activities, including prescribed burning. A portion of the carbon removed would remain stored for a period of time in wood products (US EPA 2013; Depro, et al. 2008). Additionally, motorized equipment used during any of the proposed activities will emit greenhouse gasses.

For at least the short term, on site carbon stocks would be lower under the action alternatives than under No Action. The amount of carbon stocks retained would be proportional to the number of acres and amount of vegetation treated by alternative. Actions such as those proposed in the Como Forest Health project may, in some cases, increase long term carbon storage over time (Finkral and Evans 2008; North, et al. 2009; Mitchell, et al. 2009) but current research in this field shows highly variable and situational results (McKinley, et al. 2011; Mitchell, et al. 2009; Reinhardt and Holsinger 2010; Ryan, et al. 2010).

The proposed stand vegetation and fuel reduction treatments would reduce existing carbon stocks and temporarily reduce net carbon sequestration rates within treated stands. In some areas, carbon stocks and sequestration rates may be reduced enough so that in the short term the stands would possibly emit more carbon than they are sequestering. These stands would remain a source of carbon to the atmosphere (or weakened sink) until carbon uptake by new and remaining trees again exceeds the emissions from decomposing dead organic material. The strength of the carbon sink would increase as stands continue to develop then gradually decline but remain positive (Pregitzer and Euskirchen 2004). Carbon stocks would continue to accumulate, although at a declining rate, until impacted by future disturbances.

As discussed elsewhere, the risk of some high mortality disturbance events is greater under the no action alternative. To the extent the action alternatives reduce the risk or delay the event of future large scale disturbance events, potential emissions from those events would be reduced or forestalled.

Sustaining forest productivity and other multiple-use goods and services requires that land managers balance multiple objectives. The long-term ability of forests to sequester carbon depends in part on their resilience to multiple stresses, including increasing probability of drought stress, high severity fires, and large scale insect outbreaks associated with projected climate change. Management actions, such as those proposed

with this project that maintains the vigor and long-term productivity of forests and reduce the likelihood of high severity fires and mountain pine beetle outbreaks can maintain the capacity of the forest to sequester carbon in the long-term. Thus, even though some management actions may in the near-term reduce total carbon stored below current levels, in the long-term they maintain the overall capacity of these forests to sequester carbon, while also contributing other multiple-use goods and services (Reinhardt and Holsinger 2010).

Cumulative Effects

Neither the No Action alternative, Proposed Action, nor alternatives to the Proposed Action would have a discernable impact on atmospheric concentrations of greenhouse gases or global warming. The effects of the alternatives would be indiscernible because the change in rate and timing of the predicted carbon flux in the project area would be small relative to the global scale of the atmospheric greenhouse gas pool and the multitude of natural events and human activities globally contributing to that pool.

Although not a statutorily defined purpose of National Forest System management, forests do provide a valuable ecosystem service by removing carbon from the atmosphere and storing it in biomass (Galik and Jackson 2009). U.S. forests are a strong net carbon sink, absorbing more carbon than they emit (Houghton 2003; US EPA 2013; Heath, et al. 2011). For the period 2000 to 2008, U.S. forests sequestered (removed from the atmosphere, net) approximately 481.1 teragrams of carbon dioxide per year, with harvested wood products sequestering an additional 101 teragrams per year. Our National Forests accounted for approximately 30 percent of that net annual sequestration. National Forests contribute approximately 3 Tg carbon dioxide to the total stored in harvested wood products compared to about 92 Tg from harvest on private lands (Heath, et al. 2011).

The total carbon stored on the Bitterroot National Forest is approximately 94 Tg, or about twenty-one one hundredths of one percent (0.21) of approximately 44,931 Tg of carbon stored in forests of the coterminous U.S. (Heath, et al. 2011). The Como Forest Health Project would affect only a tiny percentage of the forest carbon stock of the Bitterroot National Forest, and an infinitesimal amount of the total forest carbon stock of the United States.

Within the U.S., land use conversions from forest to other uses (primarily for land development or agriculture) are identified as the primary human activities exerting negative pressure on the carbon sink that currently exists in this country's forests (McKinley, et al. 2011; Ryan, et al. 2010; Conant, et al. 2007). The affected forest lands in this proposal would remain forests, not converted to other land uses, and long-term forest services and benefits would be maintained.